

Department of the Interior
U.S. Geological Survey

**LANDSAT THEMATIC MAPPER (TM)
RAW COMPUTER COMPATIBLE (RCC)
DATA FORMAT CONTROL BOOK (DFCB)**

Version 2.0

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Executive Summary

This Data Format Control Book (DFCB) provides the U.S. Geological Survey (USGS) and the Landsat International Ground Stations (IGSs) with a clear and concise reference document to assist in the generation, archival, validation, and exchange of Landsat Thematic Mapper (TM) Raw Computer Compatible (RCC) data.

This document is under the control of the Landsat Configuration Control Board (LCCB). Submit Landsat Configuration Change Requests (LCCR) to this document, as well as supportive material justifying the proposed changes, to the Mission Management Office (MMO), located at the USGS Center for Earth Resources Observation and Science (EROS) near Sioux Falls, South Dakota.

Document History

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Section 1 Raw Computer Compatible (RCC) Data Format

The Thematic Mapper (TM) Raw Computer Compatible (RCC) data format is comprised of wideband data downlinked from either the Landsat 4 (L4) or Landsat 5 (L5) spacecraft and stored on tape media. This format supports either single or multiple L4/L5 downlinks stacked on a single tape media. L4 ceased acquiring data in August 1993 due to failures of the onboard data transmitters. The L4 has since been decommissioned; however, this document provides formatting instructions for both L4 and L5 TM data.

1.1 Wideband Data

The L4/L5 science payload data from the TM instrument are referred to as “wideband data.” Onboard the spacecraft, the image data, along with ancillary attitude and ephemeris data, are organized into a single data stream format. The serial data do not have to be byte-aligned. Data from the Multispectral Scanner (MSS) instrument (not currently in use) are also multiplexed onto a separate data stream format. These two formats are then multiplexed and transmitted to a ground receiving station using Unbalanced Quadrature Phase Shift Keying (UQPSK) modulation. The inphase (“I”) component contains the TM data at 85 MBPS, and the quadrature component (“Q”) contains the MSS data at 15 MBPS. Because the MSS is not operational, only the data from TM are present in the downlink (D/L), which degenerate into Biphase Shift Keying (BPSK) at 85 MBPS.

In early 2002, the USGS determined that in Scan Angle Monitor (SAM) mode, the L5 TM sensor’s scan mirror turn-around time had increased to the point in which the scan mirror could no longer maintain synchronization with the calibration shutter. In response to this problem, the U.S. Geological Survey (USGS) transitioned L5 to bumper mode in April 2002. While in bumper mode, the L5 TM sensor does not attempt to align successive scans during operations. Ground stations receiving bumper mode data shall not correct these misalignments either before or during the generation of TM RCC data. TM RCC data collected in bumper mode shall contain the original scan misalignments as collected from L5.

For the purposes of generating the L4/L5 archive and exchange format, it is necessary to provide the data file(s) in a computer compatible byte format. When reconstructing the serial data stream to generate TM RCC data, the data must conform to the specifications of the Landsat D (Landsat 4/5) Data Format Control Book (DFCB), Volume V, Payload (Reference Document 2).

1.2 Writing Raw CC Data to Tape Media

1.2.1 Single L4/L5 Downlink

Each L4/L5 downlink file is written using the GNU tar command. The following example illustrates the LINUX commands required to write a single contact to tape media:

```
tar -cvf /dev/nstxx L5TB2003116140053EDC012I00.data
```

This example command creates a GNU tar file for a single downlink and does not rewind the tape, so a second file can be appended to the tape media appropriately. See 2.1 for RCC file naming conventions.

1.2.2 Multiple L4/L5 Downlinks

When recording multiple downlinks to tape media, the single downlink process outlined in 1.2.1 shall be followed for the first downlink. After the first downlink writes to tape media, the second and any subsequent downlinks shall be written to tape using the GNU tar command sequence specified for a single downlink. For example, five separate downlinks, when written to tape, will result in five separate tar files on the same tape media. Spanning data files across multiple tapes is not permitted; an individual downlink data file must be contained on a single tape. See 2.1 for RCC file naming conventions.

The following example illustrates the LINUX commands required to write multiple contacts to a single tape media:

```
tar -cvf /dev/nstxx L5TT1990214123458EDC011I00.data  
tar -cvf /dev/nstxx L5TT1995116140053EDC012I00.data  
tar -cvf /dev/nstxx L5TB2003120142515EDC011I01.data
```

Section 2 RCC File Name Specifications

This section outlines the RCC data file naming convention.

2.1 RCC Data File Naming Convention

The raw computer compatible data file naming convention is as follows:

VNIMYYYYDOYHHMMSSGSICDIAVV.data

Table 2-1 outlines the parameters that comprise the raw computer compatible file naming convention.

Parameter	Filename Positions	Description
Vehicle Series	V	"L" for Landsat.
Vehicle Number	N	"4" for Landsat 4 and "5" for Landsat 5.
Instrument	I	"T" for TM.
Sensor Mode	M	"T" for SAM mode, "B" for Bumper Mode.
Year	YYYY	The year that the spacecraft downlinked the TM data.
Day of Year	DOY	Julian day of year that the spacecraft downlinked the TM data.
Hour	HH	Greenwich Mean Time (GMT) hour of day that the spacecraft downlinked the TM data.
Minute	MM	Minute of the hour that the spacecraft downlinked the TM data.
Second	SS	Second of the minute that the spacecraft downlinked the TM data.
Ground Station Identifier	GSI	Ground station identifier of the station to which the spacecraft downlinked the TM data.
Capture Device Identifier	CDI	"C" = Alpha or numeric character "D" = Alpha or numeric character "I" = Either an alpha or numeric character may be used for stations receiving single downlinks. Stations receiving dual downlinks shall ensure the "I" position is a unique numeric character (0-9).
AQPSK Channel	A	Channel identifier: "I" for TM RCC files
VV	Version	2-digit file version number (starting with 01). Any ground station not participating in versioning data always uses 00.
.data	.data	".data" = File extension for the raw wideband data in binary format. Required.

Table 2-1. Raw Computer Compatible Data File Naming Convention Parameters

2.2 Example RCC File Names

The contents of the transmittal tape media containing a single downlink should resemble the following:

<u>RCC File Name</u>	<u>File size in bytes</u>
L5TB2003116140053EDC012I00.data	6165626880

The contents of the transmittal tape media containing three separate downlinks should resemble the following:

<u>RCC File Name</u>	<u>File size in bytes</u>
L5TT1990214123458EDC011I00.data	6249512960
L5TT1995116140053EDC012I00.data	3165626880
L5TB2003120142515EDC011I01.data	5918162944

References

Please see <http://landsat.usgs.gov/resources/acronyms.php> for a list of acronyms.

USGS/EROS. LS-DFCB-07 (SVS-10126). Landsat D Data Format Control Book. Volume V (Payload). July 1981.

USGS/EROS. LS-ICD-41. Landsat 5 (L5) International Ground Stations (IGS) Interface Control Document (ICD). Version 6.0. October 2005.

USGS/EROS. LS-PD-55. Landsat 5 (L5) Thematic Mapper (TM) Data Validation and Exchange Implementation Plan. Version 1.0. February 2006.

Memorandum of Understanding (MOU) Between the US Government and International Cooperators. Revision 2. August 2002.